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Köhne, H.-L.; Sawyer, A.

Veröffentlichungsversion / Published Version
Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:

Köhne, H.-L., & Sawyer, A. (2018). Process innovation: requirements and opportunities. *European Journal of Management Issues*, 26(1-2), 22-28. <https://doi.org/10.15421/191803>

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UDC classification: 336

JEL Classification: O31

Process innovation: requirements and opportunities

H.-L. Köhne[†]
A. Sawyer[#]

Purpose. The purpose is to assemble the list of the most important requirements and opportunities of process innovation through the analysis of the main and most recent scholarly developments related to the study of process innovation.

Design/Method/Approach. Systematic literature review.

Theoretical implications. In outlining the requirements and opportunities of process innovation, this article builds a foundation for understanding process innovation and an introduction to terms and ideas related to process innovation. From such foundation, scholars can further develop the study of process innovation and the understanding of the main factors that contribute to its success.

Practical implication. Process innovation is linked to a high failure rate (between 50% - 80%), which acts as a deterrent for many managers and companies. Through understanding the requirements and opportunities of process innovation, managers can intelligently decide whether it is best for their company to pursue or avoid process innovation.

Originality/Value. Articles have shared, in small parts, the requirements and opportunities of process innovation, but this article is original due to its listing of the most important requirements and opportunities of process innovation.

Research limitations/Future research. This article shares the requirements and opportunities of process innovation, but it does not rank or list either the requirements or opportunities based on their importance to process innovation. Additionally, this article does not quantitatively assess the requirements and opportunities importance to process innovation. Future research can rank the requirements and opportunities of process innovation based on their contribution to the success and/or failure of process innovation within a firm or an industry.

Paper type – conceptual.

Keywords: process innovation; process reengineering; literature review.

[†]Hannah-Luisa Köhne,
B.Sc., master student,
Frankfurt School of Finance and Management,
Frankfurt am Main, Germany,
e-mail: hannah-luisa.k@hotmail.de
<https://orcid.org/0000-0002-7149-6045>

[#]Anwar Sawyer,
B.Sc., master student,
Frankfurt School of Finance and Management,
Frankfurt am Main, Germany,
e-mail: anwarpsawyer@gmail.com
<https://orcid.org/0000-0003-2027-7632>

Reference to this paper should be made as follows:

Köhne, H.-L., Sawyer, A. (2018). Process innovation: requirements and opportunities. *European Journal of Management Issues*, 26(1-2), 22-28.
doi:10.15421/191803.

Інновація процесів: вимоги та можливості

*Ханна-Луїза Кьоне[†],
Анвар Соїєр[#]*

[†] Франкфуртська Школа Бізнесу і Менеджменту,
Франкфурт-на-Майні, Німеччина,
[#] Франкфуртська Школа Бізнесу і Менеджменту,
Франкфурт-на-Майні, Німеччина

Мета роботи – скласти перелік найбільш важливих вимог і можливостей інновації процесів шляхом дослідження та аналізу основних і найновіших наукових розробок, пов'язаних з її вивченням.

Дизайн/Метод/Підхід дослідження – системний огляд літератури.

Результати і теоретичне значення дослідження. Шляхом викладення вимог і можливостей інновації процесів, цією статтею створено основу для її розуміння; введено терміни і поняття, пов'язані з інновацією процесів. Ґрунтуючись на результатах даної роботи, можливо спланувати подальші дослідження інновації процесів і розвивати розуміння основних факторів, що сприяють її успіху.

Практичне значення дослідження. Виявлено, що інновація процесів пов'язана з високою кількістю невдач (від 50 до 80%), які стають стримуючим фактором для багатьох менеджерів і компаній. Завдяки розумінню її вимог і можливостей, менеджери можуть обґрунтовано вирішити питання про доцільність продовження або припинення інновації процесів в своїй компанії.

Оригінальність/Цінність/Наукова новизна дослідження. У джерелах, використаних для аналізу при проведенні даного дослідження, тільки в тій чи іншій мірі описані загальні вимоги і можливості інновації процесів. Оригінальність даної роботи полягає в тому, що в цій статті зведено до єдиного найбільш важливі вимоги і можливості інновації процесів.

Обмеження дослідження/Перспективи подальших досліджень. У даній статті вимоги і можливості інновації процесів описано, але за рівнем важливості для неї їх не проранжовано. Важливість вимог і можливостей інновації процесів також кількісно не оцінено. У подальших дослідженнях таке ранжування вимог і можливостей можливо виконати на основі їх внеску в успіх і / чи провал інновації процесів для окремої фірми або для окремої галузі.

Тип статті – теоретична.

Ключові слова: процесна інновація; реорганізація процесів; аналіз літератури.

Инновация процессов: требования и возможности

*Ханна-Луиза Кёне[†],
Анвар Соьер[#]*

[†] Франкфуртская Школа Бизнеса и Менеджмента,
Франкфурт-на-Майне, Германия,
[#] Франкфуртская Школа Бизнеса и Менеджмента,
Франкфурт-на-Майне, Германия

Цель работы – составить перечень наиболее важных требований и возможностей инновации процессов путем анализа основных и самых новых научных разработок, связанных с ее изучением.

Дизайн/Метод/Подход исследования – системный обзор литературы.

Результаты и теоретическое значение исследования. Путем изложения требований и возможностей инновации процессов, данной статьей создана основа для ее понимания; введены термины и понятия, связанные с инновацией процессов. Основываясь на результатах данной работы, возможно спланировать дальнейшие исследования инновации процессов и развивать понимание основных факторов, способствующих ее успеху.

Практическое значение исследования. Виявлено, что инновация процессов связана с высоким количеством неудач (от 50 до 80%), которые становятся сдерживающим фактором для многих менеджеров и компаний. Благодаря пониманию её требований и возможностей, менеджеры могут обоснованно решить вопрос о целесообразности продолжения или прекращения инновации процессов в своей компании.

Оригинальность/Ценность/Научная новизна исследования. В источниках, использованных для анализа при проведении данного исследования, только в той или иной мере описаны общие требования и возможности инновации процессов. Оригинальность данной работы заключается в том, что в этой статье сведены воедино наиболее важные требования и возможности инновации процессов.

Ограничения исследования/Перспективы дальнейших исследований. В данной статье требования и возможности инновации процессов описаны, но по уровню важности для неё они не проранжированы. Важность требований и возможностей инновации процессов также количественно не оценена. В дальнейших исследованиях возможно выполнить такое ранжирование требований и возможностей на основе их вклада в успех и/ли провал инновации процессов для отдельной фирмы или для отдельной отрасли.

Тип статьи – теоретическая.

Ключевые слова: процессная инновация; реорганизация процессов; анализ литературы.

Introduction

The future of business processes and customer offerings is vast and unpredictable. This uncertainty has led to a race between firms to be among the first to discover and implement improved methods and offerings utilizing new and existing technology (Linton, & Walsh, 2004). Once achieved, these improvements of processes, methods and offerings are associated with competitive advantage and long term firm survival (Tarafdar, & Gordon, 2007). As a result, many companies are highly motivated to better understand and implement process innovation as means to improve their processes, methods and offerings.

Process innovation is the implementation of a new or significantly improved production or delivery method that is of value to the user; process innovation includes significant changes in techniques, equipment and/or software (OECD and Eurostat, 2005). While the positive results of process innovation are on average beneficial to the improvement of firm performance, there are risks associated with process innovation (Altinkemer et al., 2011). This article explores the requirements, opportunities and the reasons for failure of process innovation.

The purpose of this article is to contribute to the development of the process innovation subject and provide insights to opportunities stemming from new technologies to the further development of process innovation. To do this, this study performs a literature review of articles within the last 5 years related to process innovation. This literature review analyses each article's theoretical relation to process innovation.

Research Question

This article implements a systematic review of process innovation literature and analyzes the development of “process innovation”, “process reengineering” and more process innovation related theories over the last 10 years. This approach is done to address the following questions: What are the requirements and opportunities of process innovation and how to avoid common mistakes related to process innovation?

Methods and Data

The literature review was conducted using the methodological approaches established by Webster and Watson (2002) and vom Brocke and colleagues. In a first step, searches with a range between 2012 to 2017 were performed on JSTOR and Emerald Insight databases, with keywords of “Process Innovation” and “Process Reengineering”. The searches from both databases resulted in the sourcing of 28 articles. In a second step, the journals of each article were cross-referenced against the SCImago journal ranking system. The SCImago journal ranking system ranks journals based upon the number of citations and the quality of such citations. The ranking scale ranges from Q1 (highest rated) to Q4 (the lowest rated). The articles selected were only taken from Q1 ranked journals, which refined the search to 15 research articles. From these 15 articles, the number of articles were reduced to 7 due to the lack of direct focus on process innovation. The rejected 8 articles focused either on innovation, innovation process, or product innovation.

Supplementary to the 7 articles chosen, EBSCOhost with Business Source Premier database was included to the list of databases searched under the keyword, “Process Innovation”. The reason for this decision is after adapting the concept-centric literature review approach (Webster, & Watson, 2002), concepts were grouped, but the 7 articles did not adequately address the outlined concepts (Appendix 1). From EBSCOhost with Business Source Premier

database 10 articles were identified, out of 10 articles 4 articles met the Q1 SCImago ranking and covered the missing concepts outlined on the concept matrix. In all cases, the articles researched were only peer-reviewed literature.

Results of Systematic Review

The literature review process resulted in the identification of 19 articles for this article's analytical review. These articles were classified in their relation to the concepts outlined in the Concept matrix. From the article's concept matrix, 15 articles contributed to Concept A, the requirements of Process innovation. There were 8 articles which contributed to Concept B, the opportunities of process innovation, of 7 articles covered Concept C, the methodology of process innovation. Concept D, the technology of process innovation, related to 10 articles that were researched. Additionally, 6 new articles were selected for the “Go Backward” step (Webster, & Watson, 2002). A step in which the citations for the selected articles were reviewed to identify prior articles (including those articles outside the before described 5-year range) to contribute to crucial aspects of theory. Once categorized and reviewed, the content from the articles were utilized to create a mind map to assist in the development of the following article (fig. 1).

Current State of Knowledge

The theory on process innovation, also referred to as process reengineering, was once described by Hammer and Champy as “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed” (1993, p. 32). This definition referred to rapid change of processes, which faced in the 1980s challenges from scholars due to low employee commitment. Researchers argue that many employees did not welcome such changes due to the perceived negative impacts on firm success and layoffs (Altinkemer et al., 2011).

The employee perception was not far from reality. Process innovation is related to high failure rates. On average, researchers estimate a failure rate above 50% (Altinkemer et al., 2011) for process innovation projects and for many reasons, which will be discussed in the requirements section. “For example, process innovation in emerging fields such as nanotechnology is often associated with high levels of uncertainty regarding the eventual manufacturing costs, and steepness of the learning curve” (Linton, & Walsh, 2004, p. 181). Yet, process innovation for many firms is a risk worth taking.

A firm's willingness to innovate is an important factor in implementing process innovation. According to Lampe, “If an organization is less willing to adopt process innovations, it is also most likely less willing to change existing internal relationships” (2017, p. 709). Process innovations change relationships amongst organizational members and thus affect roles, rules, structures as well as procedures (Damanpour, 1991). Organizational support and employee buy-in are crucial risk factors to the success of process innovation projects.

Despite these risks factors, the development of process innovation has prevailed due to its strong correlation to competitive advantage (Tarafdar, & Gordon, 2007). Such developments have been in the distinction between radical process innovation, the delivery of ‘new to the market’ methods and incremental process innovation, which can be defined as the delivery of either ‘significantly improved’ or ‘new to the company’ methods (Ashok et al., 2016). Other developments to process innovation were the distinction between process innovation – based strategies and requirements and product-based innovation strategies and requirements (Linton, & Walsh, 2004).

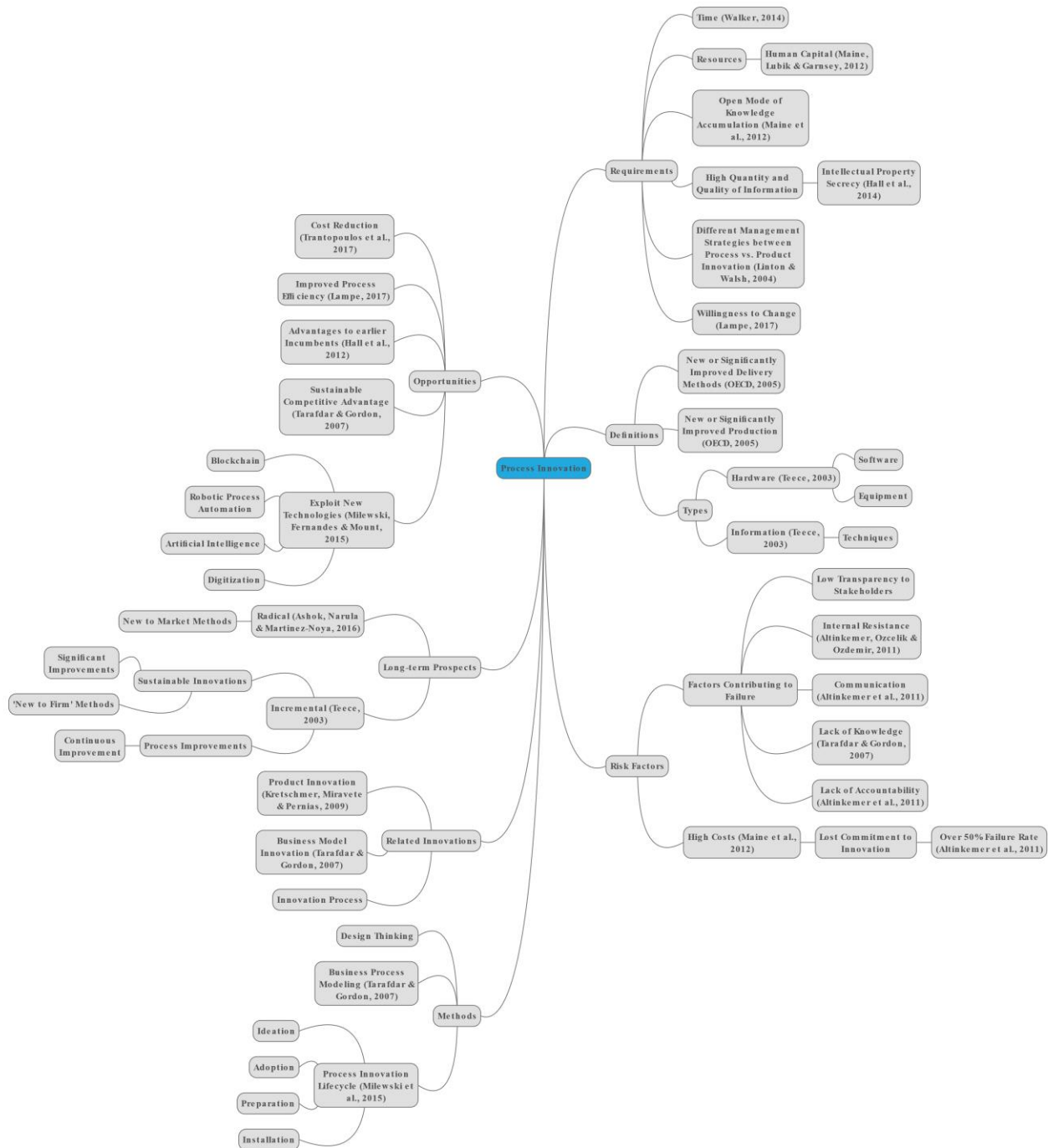


Fig. 1. Mind Map

Understanding the Requirements of Process Innovation

There are many requirements, but for the purpose of this article only the requirements which were identified in the literature review will be discussed.

1. Technology & Congruency. Technology is one of the main structures supporting a company's core processes. Furthermore, it influences and affects every decision a company faces. When an organization launches new technologies that improve processes, they are performing process innovation. Such technological infrastructure has to be launched and reconfigured to the needs of a company. It is highly unlikely that the new technology fits into the company's internal existing organization. The congruency between technology and the company is the key factor for success. Therefore,

after a new launch, a mutual adoption has to take place between technology and the organizational structure. Technology change does not only imply adopting the technology's usual operations. It includes skills, routines and support systems of the whole organization. After technology is acquired, its implementation has to be adopted to the organizational structure (Milewski et al., 2015).

2. Knowledge. Any type of innovation knowledge is asset to a company's knowledge base. Since process innovation encloses any process within a company, it is defined as a knowledge-intensive activity. A successful implementation does not only require an expert with interdisciplinary knowledge, but also professionals with technical and management know-how with additional process knowledge. For an effective knowledge application, in process innovation, an intensive open knowledge accumulation is required as the general basis. Since several employees will be involved in the

process innovation process, their level of know-how will differ within the group. An open knowledge accumulation mode is recommended in order to combine collective intelligence and allow employees to participate fully in the process (Wang et al., 2014).

3. Resources & Capabilities. Logically, for any company to implement innovation and exploit its opportunities it is mandatory to have access to the capabilities and resources required. Consequently, companies need to align internal resources to enable knowledge management. In order to integrate diverse and extensive knowledge large sums have to be invested in: new capabilities, technologies and training programs. Based on empirical values, higher investments for knowledge management are expected for radical rather than incremental innovation (Maine et al., 2012). It must be noted that process innovation implies different management and commercialization strategies than product innovation (Linton, & Walsh, 2008).

Reasons for Failure

The main reason can be attributed to: communication barriers between functional departments. An organization has to make sure that the regarding departments interact efficiently with each other. Another explanation triggering the failure of the launch is the lack of communication internally: between Chief Investment Officers and Chief Executive Officers, but it also occurs between management and staff. Management's reluctance to change, for example committing resources to the according projects, can also be named as one of the key reasons. Since changes always require adoption of employee's and internal organizational structure- no willingness to change or no adaptation can cause the project failure (Altinkemer et al., 2011).

Additional reasons include low management buy-in and accountability and other factors related to the high levels of failure associated with process innovation. Depending on the consulted researcher the rate differs between 50-80%. Process innovation is gaining increasing popularity as well as relevance in practice (Altinkemer et al., 2011). Implementing process innovation for a business is extremely costly. Therefore, the respective company can experience a decrease in productivity and performance. High monetary costs are caused by the purchase of equipment, salaries for human capital, and trainings for using process innovation tools efficiently and effectively. Also, expenditures on expert advice e.g. consultants can occur. Reports show that on average training budgets have to be increased up to 30-50%.

Opportunities

1. Potential of Process Innovation. Understanding the requirements correctly and precisely enables one to exploit the potential of process innovation. Process innovation is a source of competitive advantages for companies. In fact, it is a crucial element for company's long-term survival by preparing companies for the permanently changing business environment (Milewski et al., 2015). By establishing a competitive advantage, organizational performance is increased. Research conducted by Damannpour and Evan (1984) has shown a positive linear relationship between innovation and performance. Additionally, it will create a cost-efficiency (Lampe, 2017). Understanding the requirements of process innovation are highly important in order to exploit company potential (fig. 2).

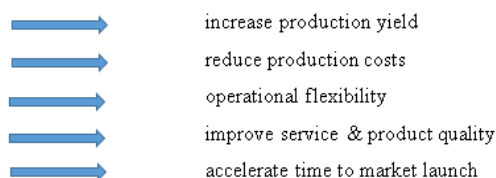


Fig. 2. The requirements of process innovation*

*Source: adapted from (Milewski et al., 2015).

2. Cost Reduction. The first opportunity from process innovation is reduced average costs of a company (Hall et al., 2012). Because of increasing returns to process innovation, larger companies have more incentives to invest in process innovation. This cost reduction presents an advantage to incumbents, who have a cost advantage over entrants. Entrants may still find it profitable to enter the market, if profits from their product innovation are sufficiently large.

As a result, entrants are not incentivized to perform process management, but this allows for an incredible opportunity for incumbents. Because of this, as well as increasing returns to process innovation, process innovation expands at the expense of product innovation (Hall et al., 2012). If incumbents continue to utilize process innovation effectively, then there is the opportunity to maintain their price advantage.

3. Knowledge Accumulation. Open knowledge accumulation is a requirement as well as an opportunity for process innovation. A key usage of the information assimilated from external partners is to implement innovation, which, however, creates a friction between the old and new knowledge (Ashok et al., 2016). Consequently, firms need to dedicate internal resources to create knowledge management (KM) practices that enable the undertaking of process innovation (Maine et al., 2012). Therefore, the friction between old and new knowledge, along with knowledge management practices that are able to manage such conflicts, help to foster a knowledge accumulation environment that further stimulates process innovation in a company.

Similar KM based environments are ideal for radically new digital technologies such as blockchain, artificial intelligence, robotic process automation and others. Therefore, we expect that the implementation of radical (as compared to incremental) process change will require higher investments in KM practices to integrate new and diverse knowledge through the creation (or adoption) of new capabilities, technologies and training programs (Maine et al., 2012).

On the other hand, once process innovation has occurred within a KM based environment, companies must choose an approach to protect such information from outside competitors. In many cases, company make patents on process innovations. However, patents on process innovations may also reveal more information than patents on products, which means companies prefer to patent product innovation and keep process innovations secret. As a result, patenting propensities are higher for product innovators (36 percent) than process innovators (25 percent). Thus, incumbents have a cost advantage over entrants (Hall et al., 2012).

4. Technology. In 1977, Teece (2003) categorized process innovation in two forms of technology transfer in his seminal study of 26 US multinational subsidiaries: First, the "hardware," such as tooling, equipment and blueprints. The second is the information that must be acquired if this hardware is to be used effectively – the required methods of the organization (Teece, 2003). Such process innovation in technology transfer has been seen to offer large opportunities for multinational and exporting companies. Many of opportunities are discovered when technological advances from a company's home country are transferred to an international subsidiary, where the same technology is not present. Thus, a competitive advantage is achieved by the multinational company in the subsidiary's country (Guadalupe et al., 2010).

Within the last 20 years, a process modeling information technology (IT) competency supports process innovation by providing structure to the redesign process and cognitive support for those involved in it (Tarafdar, & Gordon, 2007). It may also facilitate the flow of process knowledge among process experts, process designers and IS professionals (Kalpič, & Bernus, 2006). Hence, this technology provides companies an opportunity to better perform their process innovation activities.

As such, this competency may depend on a company's competency in knowledge management and may both support and strengthen

a company's competency in business-IS linkage (Tarafdar, & Gordon, 2007). The process modeling competency draws from IS human resources and appropriate software resources (Kretschmer et al., 2009). Other IT competencies can be exploited to improve process innovation activities (Milewski et al., 2015). For example, new technologies like blockchain and artificial intelligence build competencies that provide automatic support and knowledge to process innovation activities.

Conclusion

Process innovation remains a method to significantly improve processes, typically using information technology (IT), in order to gain significant improvements in key areas of performance such as service, quality, cost and speed (Altinkemer et al., 2011). To capitalize off of process innovation, companies must understand and implement the necessary requirements: technology and congruency, knowledge and resources and capabilities. The majority of literature included technology and resources and capabilities as pillars of process innovation. Although knowledge accumulation and processes was not as present in the literature, knowledge related to process innovation is associated with a high degree of change and friction between the old and new ways of working (Ashok et al., 2016). Thus, it presents one of the largest threats to company performance, if not done effectively.

On the other hand, once done effectively, companies are able to increase production yields, reduce costs, and improve operational flexibility, service and quality (Lampe, 2017). Additional opportunities related to process innovation are knowledge accumulation and technology. In both cases, companies with already established process innovation infrastructure were better positioned to continuously stimulate their process innovation centers through effective knowledge management (Hall et al., 2012) and technology processes (Kalpič, & Bernus, 2006).

Despite these opportunities, there are limitations to process innovation. The main limitation is the high rate of failure between 50-80% (Altinkemer et al., 2011). Along with the high failure rates are barriers to communication and high investments costs. These factors contribute to an environment of low management and employee buy-in. When implementing process innovation, managers must create a knowledge supporting environment as the foundation of a successful process innovation function.

Limitations and Future Research

The limitations of this article are the usage of limited keywords in the article selection process and its direct focus on the requirements and opportunities of process innovation that were most frequently seen in the literature review. The keywords utilized were "Process Innovation" and "Process Reengineering", but additional searches could have been made with terms related to innovation and process improvement. Additionally, the article does not include a comprehensive list of all requirements and opportunities of process innovation. Instead this article focuses on the most frequently seen requirements and opportunities of process innovation in the literature. The inclusion of more requirements and opportunities can contribute to the study of process innovation.

These limitations offer opportunities for future research on the topic of process innovation. In assembling a list of requirements and opportunities of process innovation, future research could search for keywords such as "creative destruction", "innovation", "radical process improvement", and more. Following this article's research process, further research would be able to identify more articles to build upon the study and understanding of process innovation. Additionally, with this article's current list of requirements and opportunities of process innovation, future research can develop a methodological or quantitative article

about process innovation, from which the requirements and their related metrics are tested against company performance. The purpose of such articles would be to identify which requirements contributes more to the success and /or failure of process innovation. In the same way, the requirements of process innovation can be tested against the opportunities of process innovation.

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Appendices

A – Concept Matrix

Table A.1

Concept Matrix: Process Innovation Requirements and Opportunities

Articles	Concepts*			
	A	B	C	D
1. Productivity and performance effects of business process reengineering: a firm-level analysis		✓	✓	✓
2. The role of external knowledge(s) in the introduction of product and process innovations	✓		✓	✓
3. How do collaboration and investments in knowledge management affect process innovation in services	✓		✓	✓
4. A quantitative approach for measuring process innovation: a case study in a manufacturing company	✓		✓	✓
5. Innovation and foreign ownership	✓		✓	✓
6. The choice between formal and informal intellectual property: a review		✓		
7. Competitive pressure and the adoption of complementary innovations	✓			✓
8. Process-based vs. product-based innovation: value creation by nanotech ventures	✓	✓		✓
9. Technology transfer by multinational firms: the resource co ring technological know-how	✓			✓
10. External Knowledge and information technology: implications for process innovation process		✓	✓	✓
11. A knowledge accumulation approach based on bilayer social wiki network for computer-aided process innovation	✓		✓	✓
12. Analyzing the past to prepare for the future: writing a literature review			✓	
13. Exploring technological process innovation from a lifecycle perspective	✓			✓
14. Internal and externa antecedents of process innovation: a review and extension	✓	✓		
15. Organizational innovation: a meta-analysis of effects of determinants and moderators	✓			
16. Understanding the influence of information systems competencies on process innovation: a resource-based view	✓	✓		✓
17. The role of external knowledge(s) in the introduction of product and process innovations	✓	✓		
18. Municipalities' willingness to adopt process innovations: evidence for higher cost-efficiency	✓			
19. Technology transfer by multinational firms: the resource co ring technological know-how	✓	✓		✓

*Concepts:

A: requirements of process innovation;

B: opportunities of process innovation;

C: methodology of process innovation;

D: technology associated with process innovation.



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